NEWSLINE
Published weekly for employees of Lawrence Livermore National Laboratory | Friday, December 13, 1996 | Vol. 21, No. 71

Lab climate experiment takes wing in record-breaking flight

By Don Johnston
NEWSLINE STAFF WRITER

A Lab-developed sensor system for conducting airborne climate measurements operated "flawlessly" during a recent record-breaking scientific flight.

The cloud detection lidar (CDL), developed by LLNL's Atmospheric Remote Sensing Program, was aloft in an Altus unmanned aerospace vehicle for 26 hours collecting data that will help scientists better understand global environmental change issues, such as global warming.

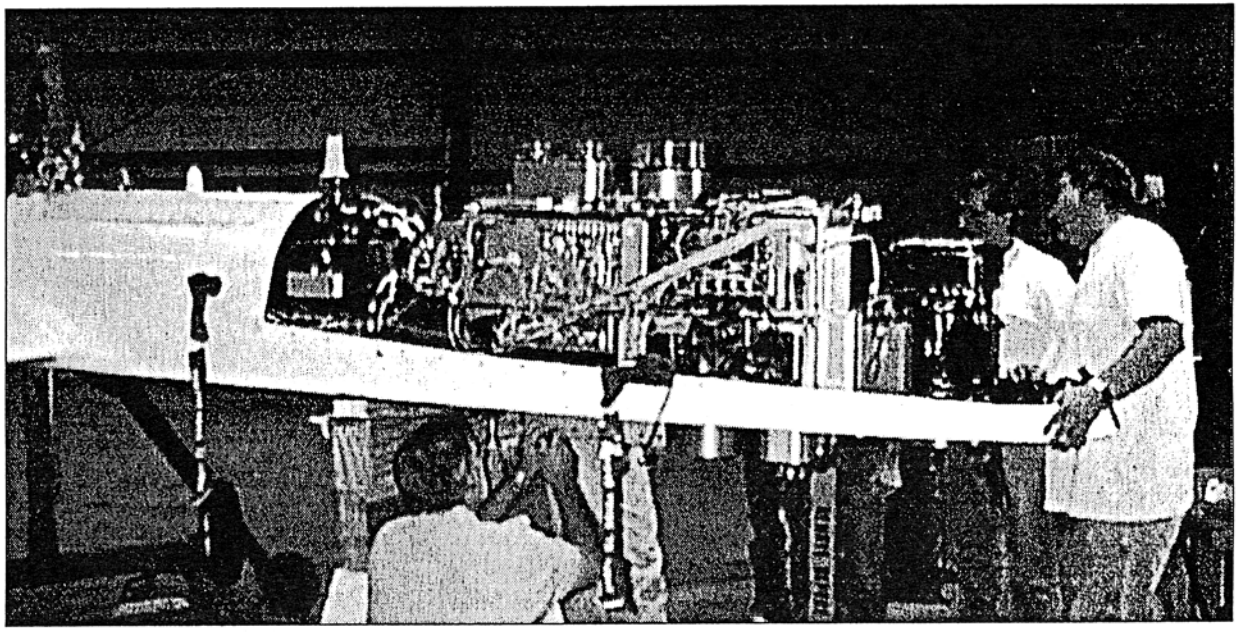
"The Altus set a new endurance record for airborne scientific study," said Arno Ledebuhr, principal investigator on the cloud detection project. "This is important because it means we can get uninterrupted, high accuracy measurements over longer periods than was previously possible with manned flights."

The cloud detection lidar instrument, attached inside the fuselage of the aircraft, detects clouds and aerosols using a series of laser pulses. A diode-pumped laser sends out pulses through a 20-centimeter-diameter telescope and a photodiode detector reads the returning photons, or "backscattered radiation."

The CDL instrument was required to be "eye-safe" because of its use on an unmanned aerospace vehicle. To make it eye-safe, the instrument uses 5,000 eye-safe laser pulses each second to generate a profile of the atmosphere out to a 20-kilometer range.

Designed to detect and profile high-altitude, thin, cirrus clouds invisible to the naked eye, the lidar operates "in concert" with two sets of broadband radiometers, one set looking up and the other set down. These radiometers detect and measure the amount of incoming radiant energy, present in both visible and infrared electromagnetic waves. Radiometric measurements are used to analyze the role of clouds in Earth temperature fluctuations.

"These measurements are critical to advancing our understanding of the Earth's climate and global warming," Ledebuhr says, noting "There's still a lot we don't know about the causes of global warming."



DICK JONES/SANDIA

An unmanned aerospace vehicle (UAV) is prepared for a scientific research flight at the Great Plains Cloud and Radiation Testbed in North Oklahoma.

"Sub-visible" cirrus clouds are extremely difficult to detect by other means and can cause significant errors in radiometric measurements when not detected.

The cloud detection "package" is composed of the lidar and two wide-field-of-view cameras, which document and provide information about the extent of cloud cover, as well as the type and variety of ground cover. This is essential to obtaining accurate radiometric measurements.

Data from the cloud detection system can also be used in conjunction with other instruments to calibrate aging weather satellites, according to Darron Nielsen, instrument engineer for the project. "Satellite sensors deteriorate over time," Nielsen says.

The use of unmanned aerospace vehicles (UAVs) like the Altus for scientific study is relatively new. The Altus is an updated version of the Predator, used for surveillance during the Gulf War. "UAVs have just become available for scientific experiments," Nielsen said.

The record-setting October flight took place over the Southern Great Plains Cloud and Radiation Testbed near Ponca City in North Oklahoma and was part of Atmospheric Radiation Measurement — Unmanned Aerospace Vehicle Program, a multi-agency, multi-laboratory effort funded by DoD's Strategic Environmental Research and Development program and DOE.

Flying at a variety of altitudes, the Altus flew laps over a 400-square-mile area.